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ABSTRACT

This study investigates age differences in children's semantic expectations regarding causal relations in stories about three realistic goal situations (being friendly, getting a dog, and doing chores). Twenty children at each of three age levels (ages 6, 9, and 12) were asked to produce stories and answer probe questions about wanting and not wanting to be friendly, to get a dog and to do chores. The probe questions focused on three types of causal relations: motives, means and obstacles. Each child was interviewed individually and sessions lasted approximately 45 minutes. A taxonomy of plausible categories of information about goal situations was developed to score the protocols. The general conclusion was: developmental changes in semantic knowledge systems for realistic goals are associated primarily with the kinds of semantic information in the knowledge base, rather than with the structure of the knowledge base. That is, if particular information was in the knowledge base, the type of causal relation associated with the information was similar across ages. In addition, "core categories" were distinguished for each age group (categories which were mentioned by at least 90% of the children in a particular age group). The Core knowledge base data indicated the presence of both developmental similarities and differences, depending on the goal situation. In general, the Core knowledge base for the older children included the same information as that of the younger children plus additional information. (Author/SS)

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The Development of Semantic Knowledge

Systems for Realistic Goals

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Current theoretical analyses of understanding stress that comprehension is a constructive process that is heavily dependent on the interaction between the form and content of the event-to-be-understood and the comprehender's expectations about the form and content of the event (e.g., Paris & Lindauer, 1977; Rumelhart, 1977; Brown, 1975; Brown, Collins & Harris, 1978). When the event-to-be-understood is a story, these expectations are derived from the comprehender's prior knowledge regarding both grammatical and semantic well-formedness in stories. Empirical work has focused on describing the grammar of stories and the development of knowledge of these grammatical rules (e.g., Mandler & Johnson, 1977; Stein & Glenn, 1978; Botvin & Sutton-Smith, 1977). Less attention has been directed toward specifying the characteristics of semantic content and rules of semantic well-formedness.

The semantic content of stories written for children, and of those produced by children, often focuses on goal directed behavior, particularly goals that occur in social and interpersonal contexts (cf. Botvin & Sutton-Smith, 1977; Stein & Glenn, 1978; Applebee, 1978). Examples of common themes are friendship, obedience, and the solution of a particular personal or interpersonal problem. The content of such stories typically deals with the reasons for setting realistic goals and successful and unsuccessful plans for attaining such goals. The child who attempts to understand

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such a story may thus need to rely not only on knowledge of the grammatical structure of the story but on his semantic expectations regarding social interactions and problem solving.

The present paper describes developmental similarities and differences in children's semantic expectations for three realistic goal situations, viz., being friendly, getting a dog and doing chores. Two aspects of semantic expectations can be distinguished: content and function. Given a particular problem solving situation, content refers to the kinds of information that are expected, i.e., seen as relevant to solution. Given that information is expected, function refers to why the information is relevant, i.e., to the type(s) of causal relation between the information and the problem solving situation. A semantic knowledge system is defined by these two aspects of semantic expectations. The set of relevant information constitutes the knowledge base and the causal relation between the relevant information and the situation constitutes the structure of the knowledge base. Developmental changes in semantic knowledge systems may be an important factor in explaining previously observed differences in the tendency to make inferences when comprehending discourse (e.g., Omanson, Warren & Trabasso, 1978; Paris & Upton, 1976).

In order to describe the nature of developmental changes in semantic knowledge systems for realistic goal situations, I used a structured interview task to collect a relatively rich data base from which children's knowledge was inferred. Second, I developed a system for describing the kinds of information found in the protocols. A taxonomy of plausible categories of semantic knowledge was developed. Protocol content was scored with respect to these categories of information. The general

conclusion of this work is the following: developmental changes in semantic knowledge systems for realistic goals are associated primarily with the kinds of semantic information in the knowledge base, rather than with the structure of the knowledge base. That is, if particular information was part of the knowledge base, the type of causal relation associated with the information was similar across ages. Following a brief discussion of the method and categories of semantic information in the taxonomy, the nature of these developmental changes in the knowledge base will be illustrated.

A structured interview methodology was used to elicit information about three realistic goal situations: being friendly, getting a dog and doing chores. Twenty children at each of three age levels--6, 9 and 12 were interviewed. During the interview, each child produced stories and answered probe questions about Wanting and Not wanting to be friendly, to get a dog and to do chores. As can be seen in the sample script in Table 1, the probe questions focused on three types of causal relations: Motives--reasons for setting the goal; Means--actions and action sequences that would cause goal attainment; and Obstacles--states or events that might prevent goal attainment.

Each child was interviewed individually and sessions lasted approximately 45 minutes. Tape recordings were made and later transcribed. Equal numbers of boys and girls were interviewed.

The analysis of protocol content involved classifying the statements in the children's protocols into a number of plausible categories of knowledge about problem solving that involves realistic goals. The

categories are represented as a taxonomy, shown in Table 2. These categories were derived through rational task analysis that began with proposals regarding characteristics of goal directed behavior, proposals that have been made by researchers in social psychology, social cognitive development and artificial intelligence. In addition, preliminary examination of the statements in the protocols indicated that children described states and actions that referred to the protagonist, i.e., the person who had the goal, to other people, and to aspects of the external environment. This was true for each of the goal situations, although the specific states and actions differed. The categories of information represent knowledge at a frame-like level (cf. Minsky, 1975). Categories are instantiated in the context of a specific goal situation. It is thus possible to compare the knowledge base for different goal situations without sacrificing the unique characteristics of a particular goal situation.

As can be seen in Table 2, there is a primary distinction among aspects of knowledge about the protagonist, about the involvement of other people and about the role of the external environment. Each of these primary distinctions is further divided into the components shown in Table 2. Rather than go into a lot of detail here, the handout includes descriptions and examples of statements that were scored as reflecting knowledge of particular categories.

Instead, I'd like to consider the characteristics of the knowledge base that were determined by applying the taxonomic categories to the children's protocols. These data are based on information that was

included in the stories and in response to the Motive, Means, and Obstacle probes. Note that the knowledge base data are independent of the type of causal relation: if the information was present in any or all of these four parts of the interview, the child received the same credit.

There were differences in the frequency with which children made statements that were classified into the various categories of semantic information. It was possible to distinguish Core categories from Non-core categories. Core categories were defined as follows: if a particular category of semantic information was included by at least 90% or 18 of the children in a particular age group, that category was identified as Core information for that goal situation. The categories that constitute the Core knowledge base for each age group and goal situation are shown in Table 3.

It is obvious from the Core knowledge base data that both developmental similarities and differences were present, depending on the goal situation. For the Dogs situation, a concrete object goal, the Core knowledge base for each age group is the same. Core includes specific actions associated with getting or not getting a dog, the protagonist's feelings about dogs and, the role played by parents and family in the protagonist's problem solution. For the other two goal situations, developmental differences in the Core knowledge base were found. The nature of these differences is elaborative: the Core knowledge base for the older children includes the same information as that of the younger children's plus additional information. Differences were largest for the Friendly situation, which is an abstract interpersonal

goal situation. Both groups of older children included information about the importance of a common location for interaction. Only the oldest children included information about establishing a basis for a friendship interaction, i.e., some joint activity. This implies an increased awareness of the reciprocal properties of friendship. The oldest children also included the protagonist's situational state, i.e., other goals the protagonist has and other activities in which the protagonist might be engaged. This implies increased awareness that friendship may conflict with an individual's independence.

Another interesting aspect of these data is increased differentiation among the goal situations. For the youngest children the Core knowledge base is almost identical across the three goal situations; the only difference is in the identity of the other person involved in problem solution. For the older children, however, the Core knowledge base tends to reflect more of the unique requirements of each goal situation.

These developmental changes in semantic knowledge systems for realistic goals are consistent with developmental trends that have been reported in other areas of semantic and conceptual development: there is a common core of information, a prototype, that becomes further elaborated with development (cf. Nelson, 1974; Rosch, 1975). Concomitantly, there is increased differentiation of concepts.

Developmental changes in the knowledge base have important implications for comprehension. The presence of a more elaborated semantic knowledge base may help explain previously reported empirical

findings that older children tend to make more causal inferences during comprehension. The fact that the knowledge base was similar for the very common situation of getting a dog leads to the possibility of empirically testing a knowledge base explanation of differences in inferential comprehension. The present work thus moves us closer toward a predictive model of comprehension that accounts for developmental and individual differences in the comprehension of goal directed problem solving behavior, whether that behavior occurs in stories or in the child's everyday social interactions.

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Table 1

Sample Interview Script

Goal situation: Getting a dog

Story about attaining goal:

E: I want you to make up a story today. The story is about you. Suppose one day you decided, "I want a dog." Tell me a story about you wanting a dog and getting one.

Motive Probe

E: Why would you want a dog in the first place? What might be a reason for wanting a dog? What might make you want a dog?

Means Probe

E: Now tell me everything you would have to do to get a dog. You told me some things in your story. What else would you do to get a dog?

Obstacle Probe

E: Now let's pretend again. Suppose one day you decided, "I want a dog." This time tell me a story where you want a dog but can't get one. What could stop you from getting a dog? What went wrong so you couldn't get one even though you wanted one?

Way Around Obstacle Probe

E: If that happened (child's obstacle), how could you still get a dog? How could you make that story into a story where you did get a dog?

Real Life Probe

E: Okay, now that was all pretend. Now in Real Life, did you ever want a dog? What happened?

Table 2

A Taxonomy of Semantic Information: Some Plausible Categories of
Knowledge about Problem Solving that Involves Realistic Goals

Major Categories and Description	Component Categories and Examples
I. PROTAGONIST'S STATES AND ACTIONS Statements that convey information about the internal states, cognitive actions, verbal actions and direct actions of the protagonist.	A. Physical state--tiredness; sleepiness; hunger; thirst. B. General emotional state--anger; fear; shame; happiness. C. Situational states and ongoing activities--I was watching television; I want to be alone; I have to do homework; I already have a lot of pets. *D. Feelings about the goal or about the anticipated outcome of attaining the goal--I like dogs; So I'll have a friend; I don't like to do chores. *E. Specific actions and skill states for attaining the goal--playing; sweeping; buying; I didn't know what to do.
II. ROLE OF OTHER PEOPLE Statements that refer to the involvement of other people in the problem solving goal situation. Component categories specify classes of other people that children's statements referred to.	A. Role of parents and family members--My dad bought it; I ask mom if I can do my chores; Mom didn't like this kid so I couldn't play with her. B. Role of non-family others--My grandma bought me a dog; My other friends teased me when I played with the new girl; The landlord said no, we couldn't have a dog. *B1. Role of specific goal object (for interpersonal goals), e.g. Friendship object--He didn't share his toys; He didn't like me. C. Influence of societal norms and rules of moral conduct--It's the right thing to do; You shouldn't steal.
III. ROLE OF ENVIRONMENT Statements that refer to the environmental availability and accessibility of resources, including goal objects, goal activities, instruments and locations necessary for the protagonist to attain the goal.	*A. Availability of goal object, or activity--There were no kids around; The store had no dogs; The house was all clean. *B. Availability of instrumental resources--We didn't have enough money for a dog; The broom handle was broken; We couldn't agree on what to do; We decided to play monopoly. *C. Availability of location--We didn't have anywhere to keep a dog; I was locked out of the house so I couldn't do my chores; I couldn't go to the park with the other kids.

* The instantiation of these categories is highly specific to each goal situation. Note also that knowledge of more than one category of semantic information was inferred from some of the example statements.

Table 3

Categories of Information in Core Knowledge Base

Core Knowledge Base	Age Group including Category		
<u>Dog situation</u>			
Protagonist's specific actions to attain goal	6	9	12
Protagonist's feelings about dogs or about anticipated outcome of attaining goal	6	9	12
Parent(s) and Family play role	6	9	12
 <u>Chores situation</u>			
Protagonist's specific actions to attain goal	6	9	12
Protagonist's feelings about chores or about anticipated outcome of attaining goal	6	9	12
Parent(s) and Family play role	6	9	12
Protagonist's situational state		9	12
 <u>Friendly situation</u>			
Protagonist's specific actions to attain goal	6	9	12
Protagonist's feelings about friendliness, friendship object, or anticipated outcome of attaining goal	6	9	12
Friendship object plays role	6	9	12
Availability of common location		9	12
Availability of basis for friendship			12
Protagonist's situational state			12